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THE COST OF ACCIDENTS TO INDUSTRY

BY

F. S. CRAWFORD

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DEPARTMENT OF COMMERCE - BUREAU OF MINES

THE COST OF ACCIDENTS TO INDUSTRY[1]

By F. S. Crawford[2]

A large number of operators of various industries in the United States do not appear to realize the great returns in dollars and cents which result from intelligently directed safety work. Managers of coal mines, metal mines, open-pit mines, quarries, steel mills, cement mills, oil refineries, iron works, or other industrial operations, should by all means realize the great waste resulting from accidents, in order to appreciate the necessity for a continuous accident-prevention policy. While the prevention of accidents is worth while from the humanitarian standpoint alone, it has an equally important economic side, and before our mining industrial operations will be made as safe as they should be, it is apparent that this dollars and cents viewpoint must be given full recognition in order to bring before many of the men who run the industries the great importance of this phase of industrial management.

There is a tendency upon the part of the operator who has not given thought to the cost of accidents (and there are many mining operators of this type) to insure his company against compensation losses and against catastrophes for which he can secure insurance, and think he has done his duty as an executive. Even though industrial operations were not compelled to pay compensation, and even if the management were not moved by humanitarian motives to try to stop accidents, it would pay many times over to carry on accident prevention work vigorously and continuously.

In some parts of the United States, the state compensation and insurance requirements are such that the operator does not receive a reduction in his insurance rate per men employed upon having made safety installations or upon having achieved a reduction of accidents in his plant. Under such conditions the management frequently does not feel encouraged to exert much effort in bettering the accident rate. However, when the responsible officials of a company realize the much greater harm to an operation which results from doing no accident-prevention work, and the great benefit in reduced costs which usually follows effective safety work, they should be inclined to do almost everything possible to reduce accidents, regardless of considerations as to accident compensations. There are enough indirect costs resulting from accidents to wreck many types of business; excessive accidents result in disorganization and failure, while immunity from accidents usually means a smoothly running efficient organization.

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1 The Bureau of Mines will welcome reprinting of this paper, provided the following footnote acknowledgment is used: "Reprinted from U. S. Bureau of Mines Information Circular 6333."

2 District engineer, U. S. Bureau of Mines.

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To the right-minded employer accident prevention is justified from a humanitarian standpoint alone. The saving of suffering to the injured man's family who must exist on reduced wages, or perhaps no wages at all, and the saving intact to a growing family of the father and provider, should be enough reason for deciding to "go the limit" in preventing accidents. There are those who say that "while it is all very fine and humanitarian, still it costs money to hire safety engineers and inspectors and to conduct safety drives, and to carry on continuous educational work." They say, "we are in business to make a profit, and if we spend a large amount of our profit on safety work and welfare work of various kinds, there will not be enough left to run the business, and soon there will be no business left in which to do safety work."

Others say "this safety business is overdone." If accident prevention does not pay its way in dollars and cents, there is at least so[illegible] excuse for its neglect by executives forced through economic pressure to pay the closest possible attention to the visible costs of production. There is no question of the necessity of maintaining production and to holding costs so that the product can be sold at a profit and the company continue in business; otherwise, as has been said, there will be no plant in which to do safety work and no occasion to pay compensation of any kind.

The operator must be brought to realize, however, that safety and efficiency go together and do not exist separately. When the manager of a plant realizes this, he loses no time in starting accident-prevention work. Operators of mines which have the lowest accident rates find that with the decrease in the number of accidents there is usually a decrease in costs and rise in efficiency. This is realized to be the only logical outcome after a consideration of all the indirect costs resulting from accidents. Some of these costs are summarized below and afterwards discussed separately.

SUMMARY OF INDIRECT COSTS OF ACCIDENTS

Direct Loss of Time Through:

1. Absence of slightly injured man securing first-aid treatment with intention of returning to job.
2. Extended absence of seriously injured workman.
3. Distraction of attention of other employees at the time of the accident.
4. Necessary assistance given to the injured man.

Indirect Loss of Time Resulting From:

1. Hiring and training new employees.
2. Training men to efficiency in new jobs.

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3. Men handling spoiled material, cleaning up spilled material or wrecks.

4. Repair men or mechanics repairing damaged equipment.

5. Preparation of accident reports and attending hearings.

Contingent Costs Resulting From:

1. Shut-down of part or all of operation due to a catastrophe.

2. Loss of good will from interruption to continuous operation and inability to deliver product.

Waste of Material and Damage to Equipment By;

1. New employees during training or inexperienced employees shifted to new jobs.

2. Injured employees who attempt to keep on working.

3. Employees distracted from work by accident.

4. Injured person at time of accident.

Increased Overhead Costs From:

1. Machinery out of service on account of accidents.

2. Decreased volume of production from the working place of the injured man.

3. Decreased volume of production from working places and machines of distracted employees.

4. Decreased production from machines operated by inexperienced employees replacing those injured.

5. Decreased productive ability of injured employee able to return to work directly after treatment.

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DIRECT LOSS OF TIME

1. Absence of Slightly Injured Man Getting First Aid Treatment

When a man is slightly injured, he should leave his work to go to the first-aid room or dispensary for treatment. Even though he gets local first-aid treatment by means of pocket first-aid packets or first-aid cabinets near the scene of his work, it is best, to avoid danger of infection, that he report to the plant dispensary for further treatment or inspection. This should be made a rule at every operation. It also is of value to get an account of the accident which caused the injury and to try to determine how the hazard may be eliminated.

It may take from 10 minutes to a half shift to get treatment and get back to work, varying with the size and kind of plant. In the meanwhile, if the man has been working with a gang, his absence is likely to be felt, and result in the delay of the remaining members of the crew. It may even be that in a small gang the remaining men are helpless to continue work until his return or replacement. Even after his return it takes a certain length of time to talk it over and then get back into the "swing" of the job. Executives have been known to tell visiting safety engineers that "a few small eye injuries resulting in medical bills are all the accidents that have been experienced." Such executives fail to realize the numerous sources of loss from apparently minor injuries. At first thought, they may appear to be of small consequence, but if carefully analyzed they are likely to show considerable loss of time by other workers who can do relatively little during the lost time to show a profit to the management.

2. Extended Absence of Seriously Injured Workman

Every employer of labor has a right to consider each of his employees as a potential profit producer. If it were otherwise, he would not be in business, but would undoubtedly put his money into some safe investment and live from the proceeds. An employer makes a certain investment in every person hired and expects him to be worth his hire. In addition, a man must make some profit for his employer, otherwise the business will not last long, the men will be out of work, and the employer himself may be looking for a job. When a man is injured and is absent, there follows a decrease in profit to the employer. The injured man is supposedly skilled; a substitute worker is a liability until he becomes trained to do his work smoothly and efficiently.

3. Distraction of Attention of Other Employees at the Time of the Accident

This is an item involving serious expense, especially at the time of a serious accident at an operation where numbers of men are working close together. Suppose a man has been "knocked out" by electric shock or by gas. Resuscitation should be begun at once, as delay is fatal. Workmen will gather, and during all this period the time of these men is wasted. If a man is badly mutilated or killed, in some instances the entire mine or plant quits for the remainder of the day.

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4. Necessary Assistance Given to Injured Man at the Time of the Accident

An injury of a serious nature requires that immediate attention and assistance be rendered by nearby workmen. If the men are untrained in first-aid methods, time will be consumed in excited discussion as to the best method to pursue, and the delay is often quite serious for the injured man. After a man has received immediate first-aid treatment he will undoubtedly need assistance or he may need to be carried on a stretcher to the ambulance or to the doctor. While all this is necessary, it takes the time of a number of men and contributes to the cost of accidents which is not shown on the cost sheet. In getting an injured man out of a mine it may be necessary to stop hoisting for an appreciable time in order to take him up on the cage; the time thus lost often can not be made up.

INDIRECT LOSS OF TIME

1. Hiring and Training New Employees

New employees must be hired and trained either to replace the injured, or to replace men transferred from other jobs to take the place of the injured. If the injured man leaves his job or machine, and production is to proceed on its regular schedule or cycle of operation, in many cases somebody must be found to take his place. Many times a "green hand" is hired or transferred to the vacated job; when this is done, it usually results in a number of mistakes which interfere with efficient operation and cause further loss of time. There is also the further possibility of accidents when a man is on work which is new to him.

When a skilled man is injured, especially a foreman, it is often necessary to fill the gap by changing the jobs of a number of men and to hire new men to do the work of lesser importance. Frequently this arrangement is necessary for the immediate performance of the work, but it unavoidably adds to the costs, through the placing of inexperienced men. Almost invariably additional lost time results from the reorganization, the productive ability of the workmen is reduced, and output is curtailed.

2. Training Men to Efficiency in New Jobs

It takes time to get a new man trained to do a new type of work smoothly and efficiently. Practically all work requires a background of experience and familiarity with the machines, surrounding conditions, method of operation, etc., before a man can attain a fair rate of production. On contracts particularly, the worker finds it practically impossible for the first few days to earn more than the minimum rate. After a time a man gets his job systematized, handles his tools and material with the ease which comes from experience, and his rate of output increases. He is then able to proceed with advantage to both himself and his employer.

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3. Men Handling Spoiled Material, Cleaning up Spilled Material, or Cleaning up Wrecks

When there is a haulage accident in a mine, cars are wrecked and material is spilled. Tracks may be damaged and timbers may be knocked out. It takes labor to clean up the damage, and somebody may be injured at the same time the accident occurs or in the "cleaning up" process. Quite often at the time of an accident, there is not only considerable ruined equipment and lost labor on material which is a total loss, but there is also additional expense incurred in assembling and removing the debris.

4. Repairing Damaged Equipment

When a wreck occurs, equipment is frequently damaged, sometimes beyond repair, or it may require the services of expert mechanics for several weeks to make repairs. The wreck is often accompanied by an injury to one or more individuals, but frequently runs into considerable additional costs aside from injury to persons.

5. Preparation of Accident Reports and Attending Hearings

In order to study the causes of accidents and work toward eliminating them, somebody should make careful detailed reports of all accidents for the use of the company itself. In addition, reports are required or requested by the State Accident Boards, Industrial Commission, safety councils, or insurance companies. Sometimes there is a doubt or dispute as to the validity or the amount of a claim, and the case must be tried before the State Compensation Board. One or more company representatives must be present as witnesses. Reports and hearings, however necessary, add still more to the total cost of accidents, and these phases of accident costs are decidedly important.

CONTINGENT COSTS

1. Shut-down of Part or All of Plant due to a Major Accident or Catastrophe

After an explosion or fire there are many cases where the whole mine plant has been shut down for long periods of time. At least a partial shut-down results from almost any disaster. A boiler explosion may wreck an entire operation. The breakdown of any prime mover such as a generator set or a steam engine would seriously interfere with output for an indefinite period. After repairs have been completed it takes weeks in some plants to get a smoothly running organization; in some cases it has been found impossible after a mine fire or explosion to regain the tonnage, costs, etc., obtained previous to the disaster.

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2. Loss of Good Will from Interruption to Continuous Operation

Good will in a business, although intangible, is one of the greatest assets and takes years to build. Any interruption to the continuous operation of a mine or plant, caused by an accident which results in heavy casualties and property damage, almost necessarily curtails production, and affects prompt deliveries. Customers become disgruntled and sometimes switch their business to other concerns; the company's reputation for prompt delivery is affected, and its good will is impaired. That this is a fact can be attested by any coal-mining company which has had a bad fire, explosion, or similar disaster, and several metal mining organizations have also been unadvertedly affected due to mine fires or other accidents involving heavy loss of life.

WASTE OF MATERIAL AND DAMAGE TO EQUIPMENT

1. New Employees During Training or Inexperienced Employees Shifted to New Jobs

New employees work awkwardly and under a handicap until they become familiar with the work. During the period of training, they may damage or break the machine they are using, or may do material damage of one sort or another to themselves, their fellow workmen, or to the mine or plant. If put to work on a job which had been nearly completed by the man who became injured, the new operator may spoil all the work done by his predecessor.

Expensive equipment can be quickly ruined, or a job on which much time and money has been expended can soon be spoiled by a new man because of his unfamiliarity with the operation; this fact is of increasing importance in mining because of the rapid increase of mechanized methods of loading, hauling, etc. The foreman usually can not remain long with the new man because he generally has too many other duties. Usually when a man is in doubt about his job he is anxious to conceal his lack of experience and often takes chances which he would not think of taking after he had been well trained in his work.

2. Injured Employees Who Attempt to Continue their Work

Men may be seriously injured, but say they are all right and can continue with their work. In most cases they would lose their pay if they went home, at least for the waiting period until compensation became effective. There is thus an incentive for a man to treat an injury lightly and attempt to keep on at work. Due to his injured condition, his mind is likely to be distracted, and in the lowering of his physical condition, either because of faintness, or possibly loss of blood, he is very much more likely to damage equipment and material. The probability of his having a more serious accident is considerably increased and his condition is very likely to be aggravated by his remaining at work.

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3. Employees Distracted From Their Work by the Accident

When a man is injured the other men give little thought to their own jobs. Their first consideration is to dash to the other man's rescue. After the excitement is over and the man has been given assistance, the rescuer may return to his job and find that he had not shut down his haulage, mining, loading, or drilling machine or that in his hurried departure he had failed to close a ventilation door, or to shut off water or electricity, etc. In some instances, men who have gone to the aid of injured fellow workman have been themselves injured or even killed while trying to aid the injured person or persons.

4. Damages Caused by the Injured Man at the Time of the Accident

There are numerous instances in which the accident to a workman has caused him to do or to fail to do something which later caused damage to the mine, costing much time and money to repair. Injuries to men who operate mining machinery such as underground hoists, pumps, loading machines, cutting machines, drills, locomotives, etc., have in numerous instances resulted in runaways of hoists or locomotives, or burning out of electric motors, etc., due to the fact that the man who was injured was unable to take the correct action to prevent the ensuing property damage.

INCREASED OVERHEAD

1. Machinery out of Service

Every piece of machinery costs money. In the course of time it will become obsolete, so it must return its cost before it has been scrapped. It must also be kept in repair. The money paid for it could have been earning interest. Thus certain fixed charges must be borne by every piece of equipment; if it is not being operated, the cost of the product is increased to the extent of the failure of the machine to produce. Such operating expenses as rent, insurance, taxes, heat, light, obsolescence, and depreciation on machinery and other equipment, interest on investments, and salaries of supervisory officials and general office force, et cetera, continue during interruption to production.

2. Decreased Volume of Production from Machines Operated by Men Who Have Been Injured

The productive ability of a man is in many cases decreased seriously when he is hurt. A large proportion of accidents which result in cuts may require small stitches, but it does not appear necessary for the man to remain away from work. Although outwardly he may appear capable of continuing his work there are at least in some instances reactions from the accident which lower his efficiency considerably. Mental anguish probably is to some extent caused by the injury and by the physical pain. The injured man is likely to lose his feeling of confidence in his job and distrust his ability and adaptability for the work. On the other hand, some men are likely to become over-cautious and work too slowly in the effort to avoid further injury. In either case there is financial loss to the employer as well as to the man.

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3. Decreased Volume of Production From Machines of Distracted Employees

An accident is likely to become a topic of conversation about the entire mine or plant, and the men are slow to get back to normal operation. Equipment is idle or working at reduced efficiency until all employees are concentrated on their jobs again. In a large operation the decreased output and the increase of overhead costs, which are the direct result, can rise to alarming proportions when there are many accidents.

4. Decreased Volume of Production From Machines Operated by Inexperienced Employees Replacing Those Injured

This is another cost item introduced by the disorganization of the work by accidents. The regular face worker or operator of a machine in a mine, for example, may have been able to load a certain number of cases of ore or of coal or to perform a certain number of operations per hour with a mining ore-loading or haulage machine before his injury. He would know just exactly what he or his machine could do. It would be necessary for an inexperienced man to learn these details from the beginning before he would be able to get the maximum returns, and during the learning period there would be decreased production with its reflected lessened earnings to the employer as well as the employee.

5. Decreased Productive Ability of Injured Employees Able to Return to Work Directly After Treatment

A man may injure his hand or fingers while at work, and after having it dressed may consider it too small an injury to cause him to stop work. On rough jobs a bandage would probably not be much of an impediment. However, on small accurate work, it is likely that a man would make slow progress with his fingers swathed in bandages. The man would try to "get by" until the wound was healed. This is about all that could be expected. Unusual exertion might open up a wound and allow infection to enter. This slowing up in his work, however, adds to the overhead costs and is one of the indirect costs resulting from accidents.

CONCLUSION

Accidents cost money far beyond the medical bills, compensation and insurance premiums paid; in fact some authorities now hold that the ultimate cost of accidents is four or five times the amount paid out in compensation, medical cost, and insurance. Safety work is a real operating problem; there is no question that efficient safety work pays for itself many times over in any industry, and that this return is reflected not only in benefit to humanity but also in dollars and cents to both employer and employee. Through the disorganization of a smoothly running department, by accidents, many extra costs creep in. These costs may be reduced to some extent by standardization of some operations and training employees so that each one has an understudy, but even in standardized operations,

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it is impossible to have idle trained operators waiting to fill the vacancy caused by an accident. Men must usually be shifted from jobs with which they are familiar to comparatively unfamiliar jobs, and production suffers for a time.

Constant vigilance in keeping down costs and keeping the plant going at a profit is the superintendent's job. When he realizes that safety work is a major part of his operation and sets forces to work to bring down the accident rate, he almost invariably discovers that he has a cleaner plant, a more smoothly running and contented organization, and lower costs, in spite of the money expended for safety work. By searching for the causes of accidents, guarding against them by all known means, both mechanical and by changes in operating methods, and by doing the most important thing of all--educating all of his employees in safe methods of working and to a conscious desire to work safely, he does a service to both his employees and to his company, including those who expect dividends.

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